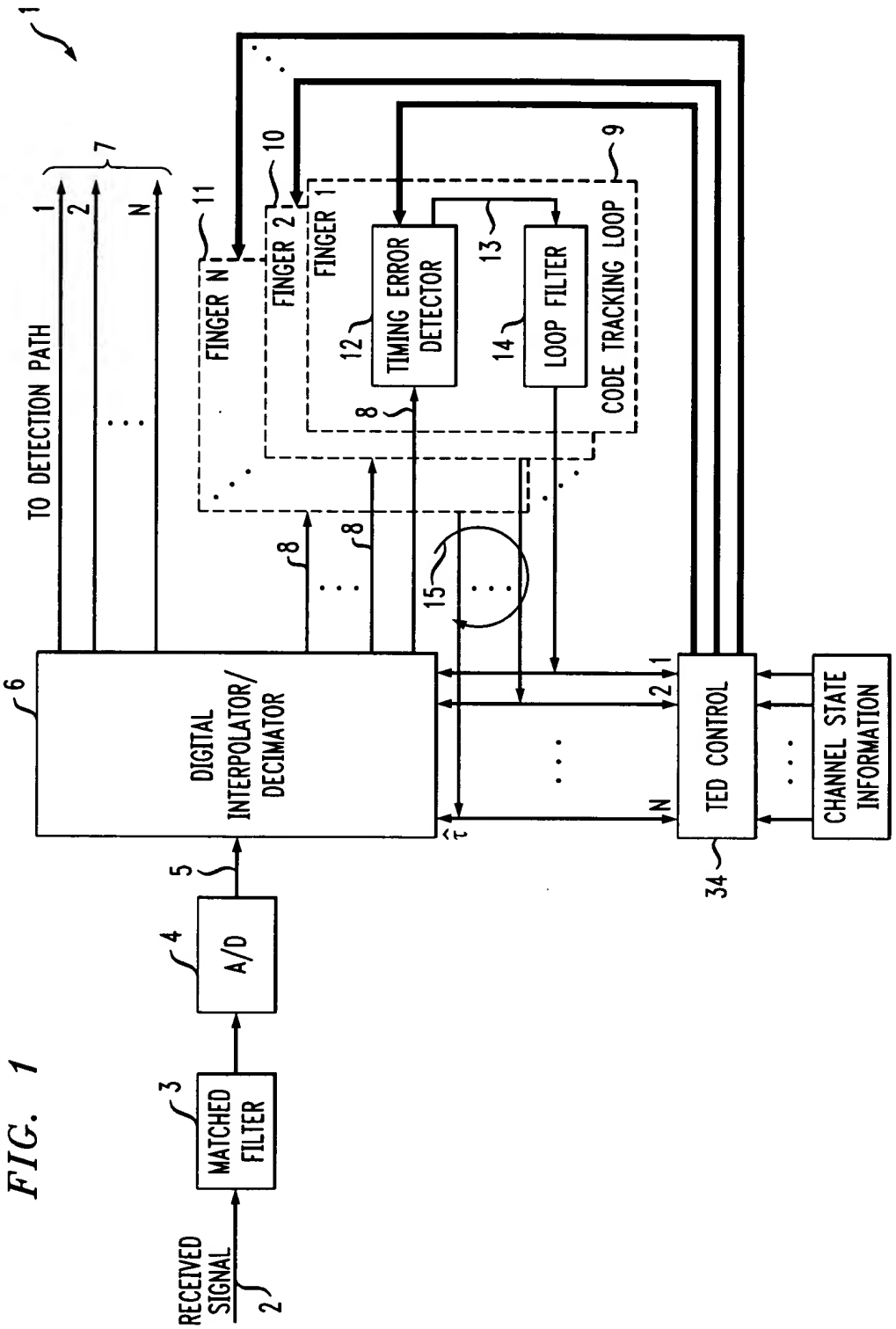


FIG. 1

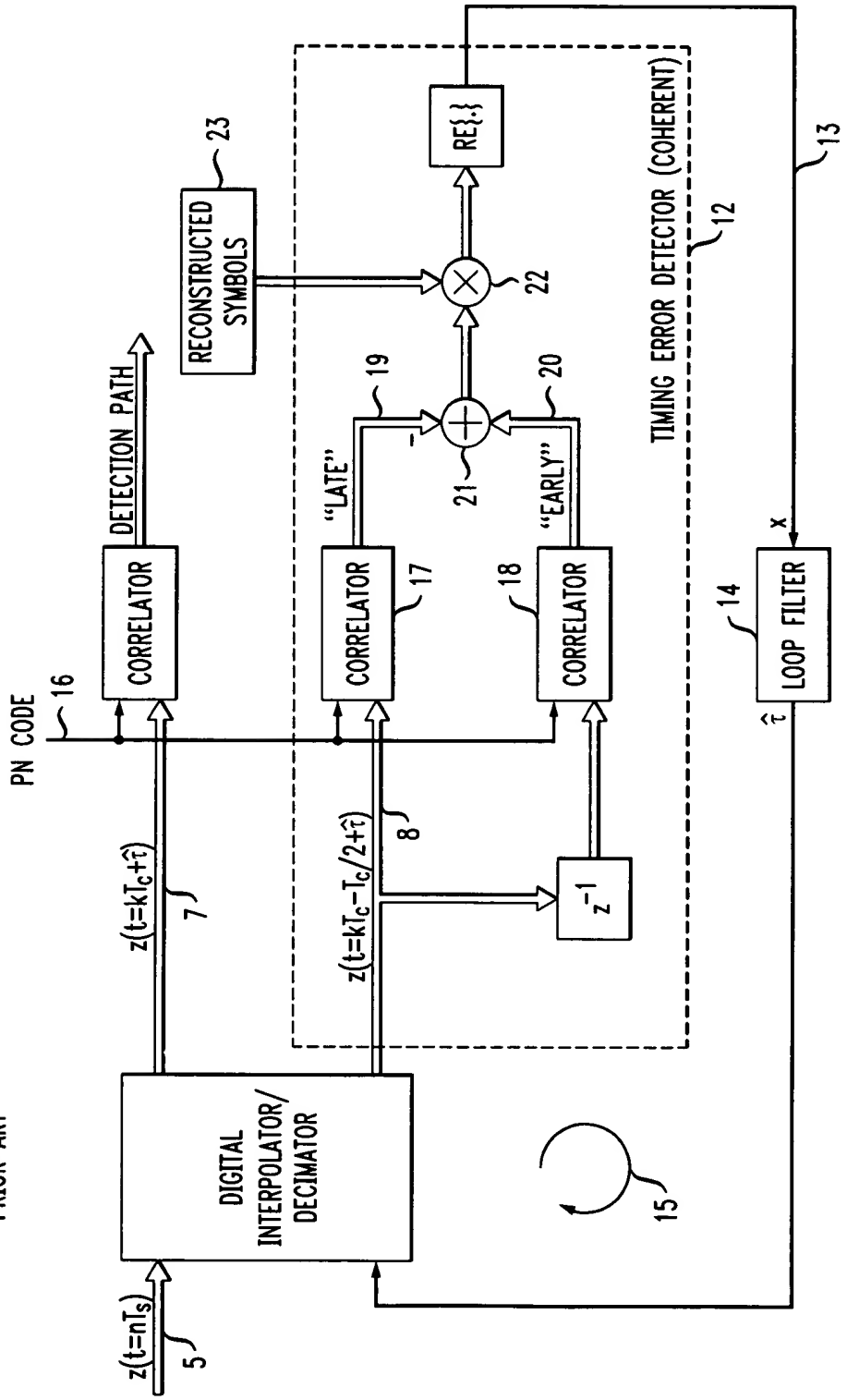


FIG. 2
PRIOR ART

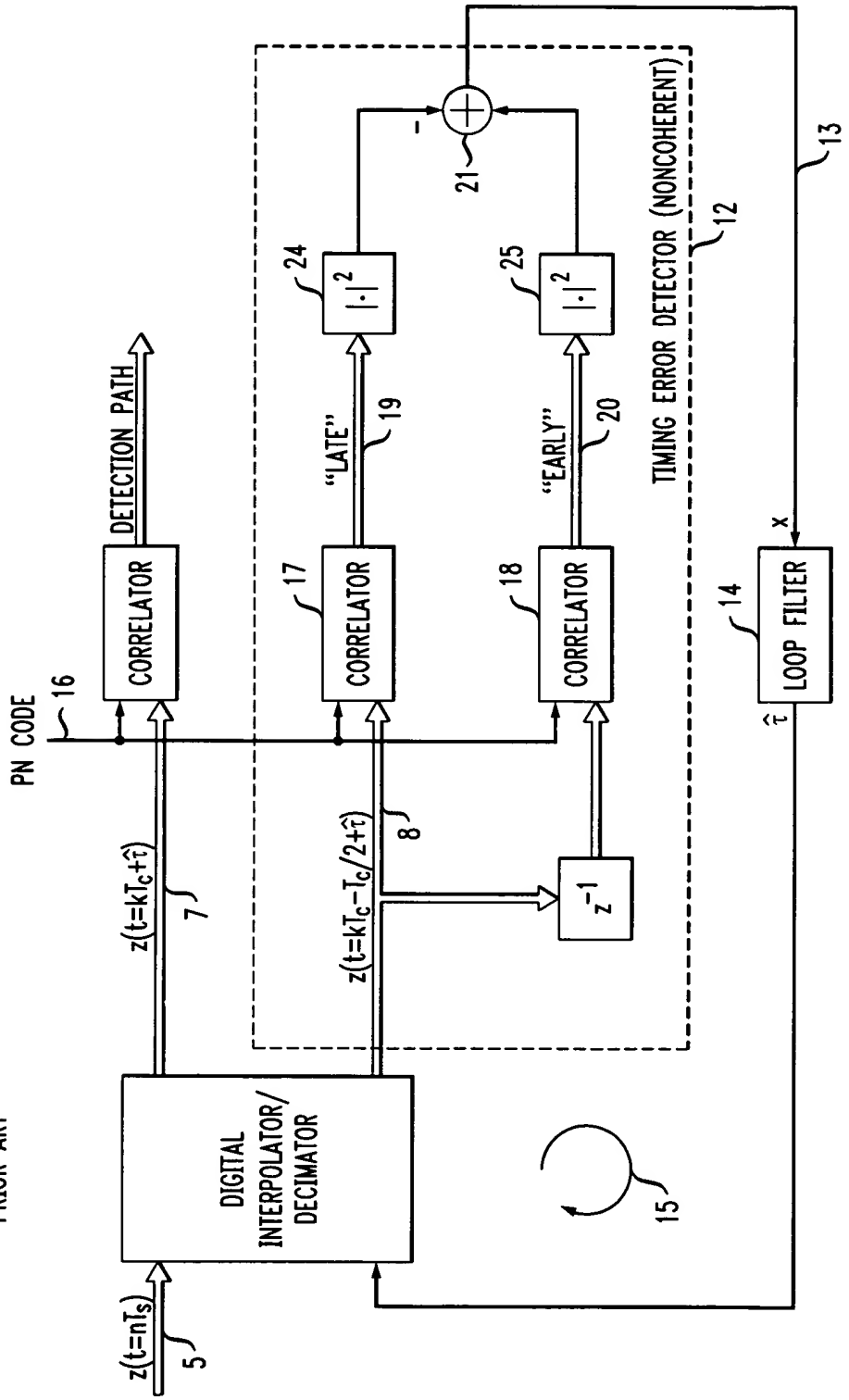


FIG. 3
PRIOR ART

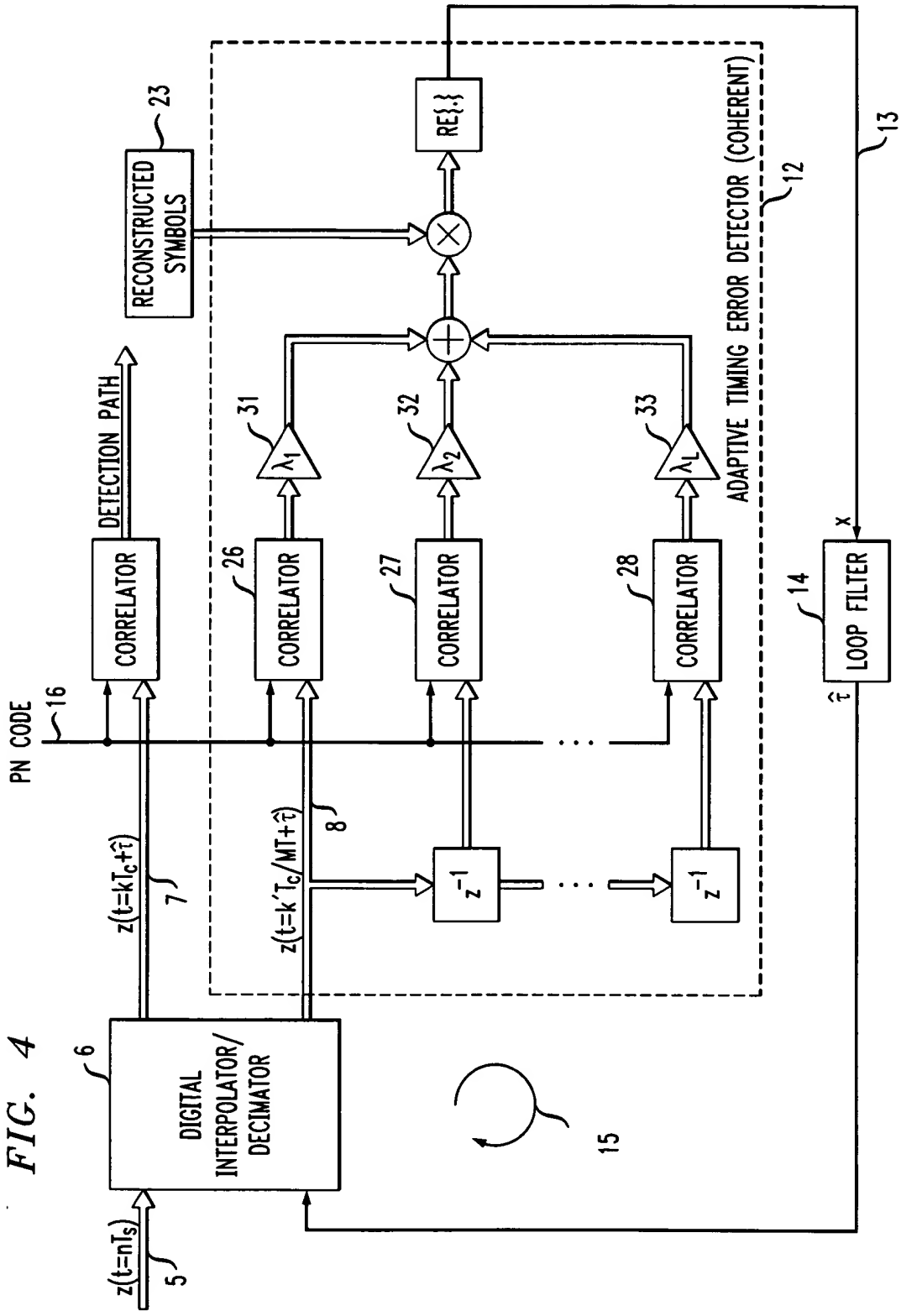

z(t=nTs)
5
DIGITAL INTERPOLATOR/ DECIMATOR
6
z(t=kTc+τ̂)
7
z(t=k'Tc/MT+τ̂)
8
PN CODE
16
CORRELATOR
DETECTION PATH
CORRELATOR
26
CORRELATOR
27
CORRELATOR
28
z⁻¹
z⁻¹
λ1
31
λ2
32
λL
33
RE{.}
RECONSTRUCTED SYMBOLS
23
ADAPTIVE TIMING ERROR DETECTOR (COHERENT)
12
LOOP FILTER
14
x
τ̂
13
15

FIG. 4

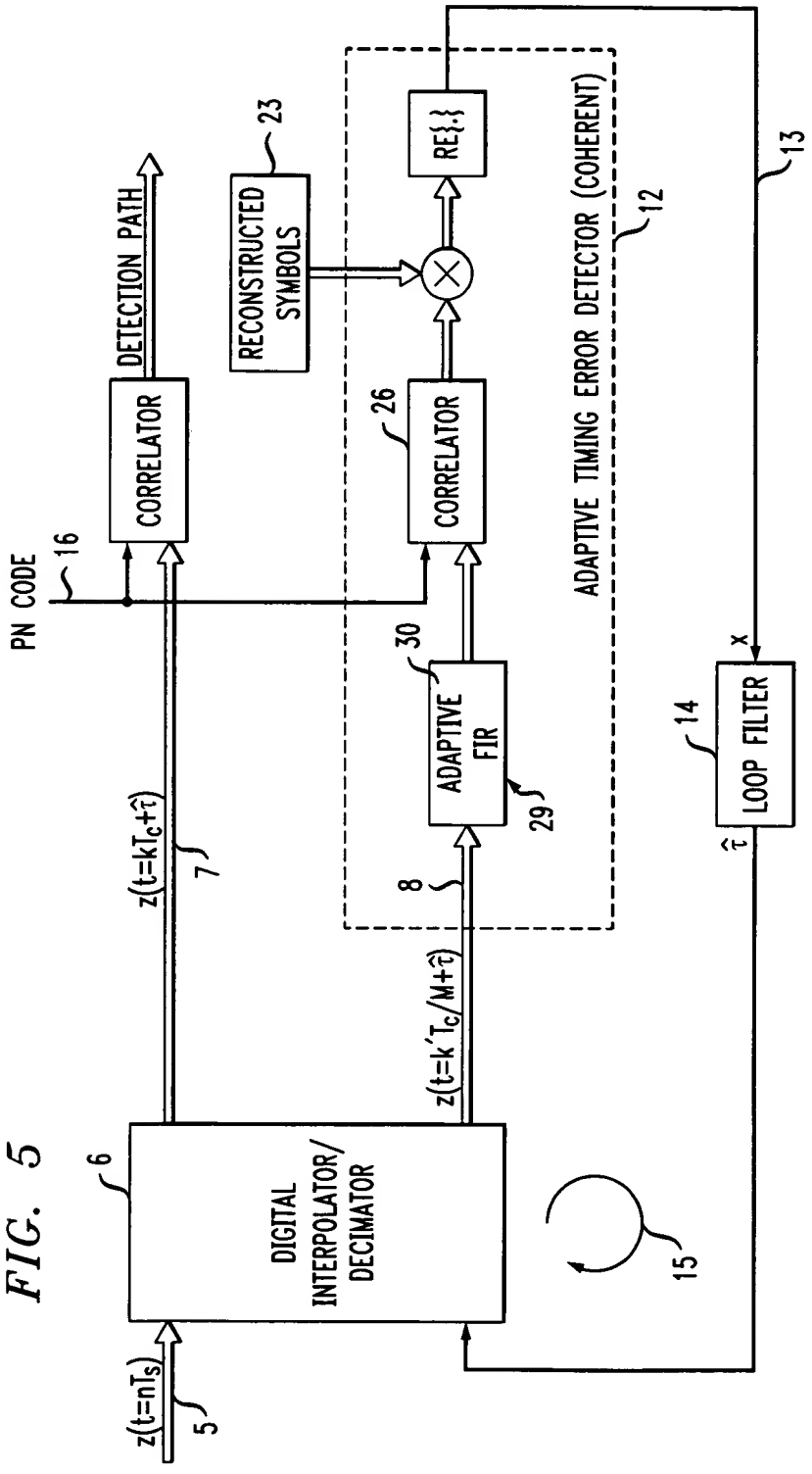

DETECTION PATH
CORRELATOR
PN CODE
16
RECONSTRUCTED SYMBOLS
23
RE{.}
ADAPTIVE TIMING ERROR DETECTOR (COHERENT)
12
13
26
CORRELATOR
30
ADAPTIVE FIR
29
x
14
LOOP FILTER
$\hat{\tau}$
$z(t=kT_c+\hat{\tau})$
7
8
$z(t=k'T_c/M+\hat{\tau})$
6
DIGITAL INTERPOLATOR/ DECIMATOR
15
$z(t=nT_s)$
5

FIG. 5

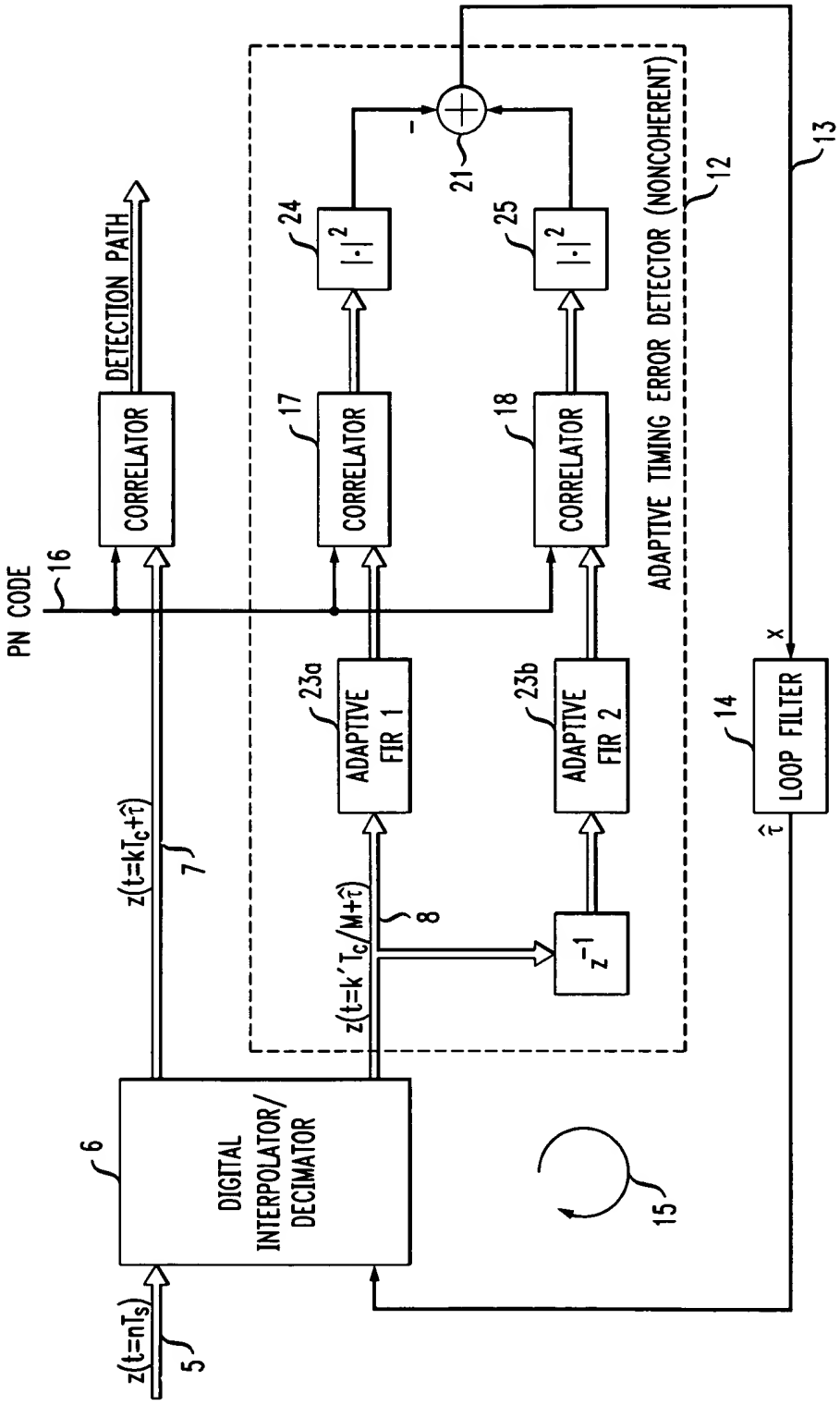

DETECTION PATH
CORRELATOR
PN CODE
16
CORRELATOR
17
CORRELATOR
18
24
$|\cdot|^2$
25
$|\cdot|^2$
21
-
ADAPTIVE TIMING ERROR DETECTOR (NONCOHERENT)
12
13
x
14
LOOP FILTER
$\hat{\tau}$
23a
ADAPTIVE FIR 1
23b
ADAPTIVE FIR 2
z^{-1}
$z(t=kT_c+\hat{\tau})$
7
$z(t=k'T_c/M+\hat{\tau})$
8
6
DIGITAL INTERPOLATOR/ DECIMATOR
15
$z(t=nT_s)$
5

FIG. 6

FIG. 7

PRIOR ART

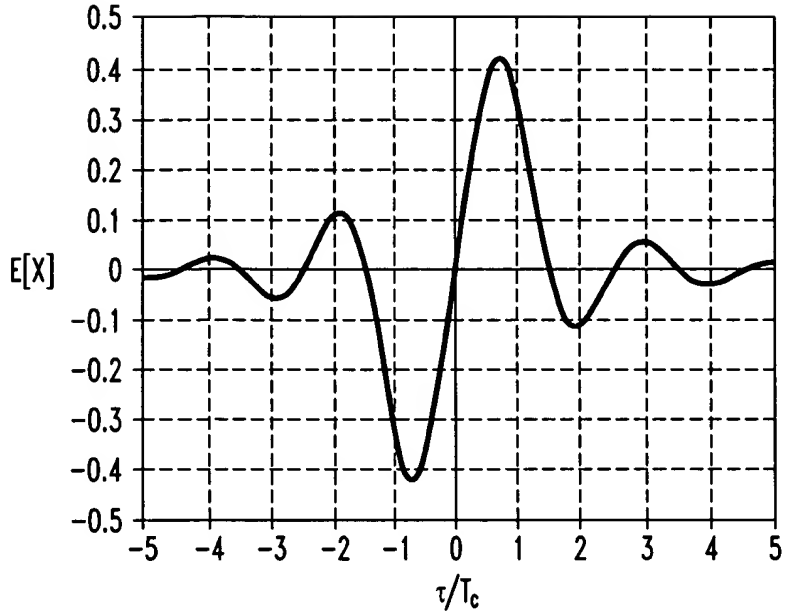


FIG. 8

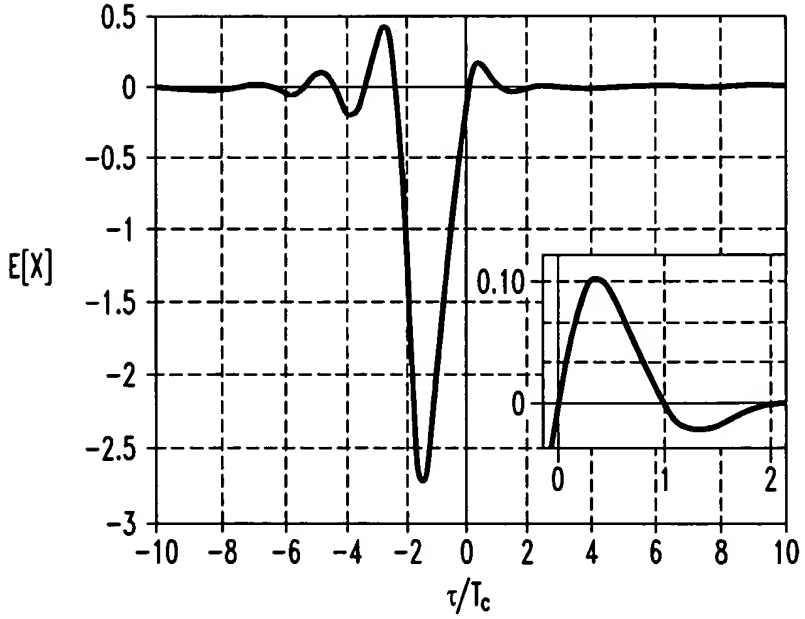


FIG. 9

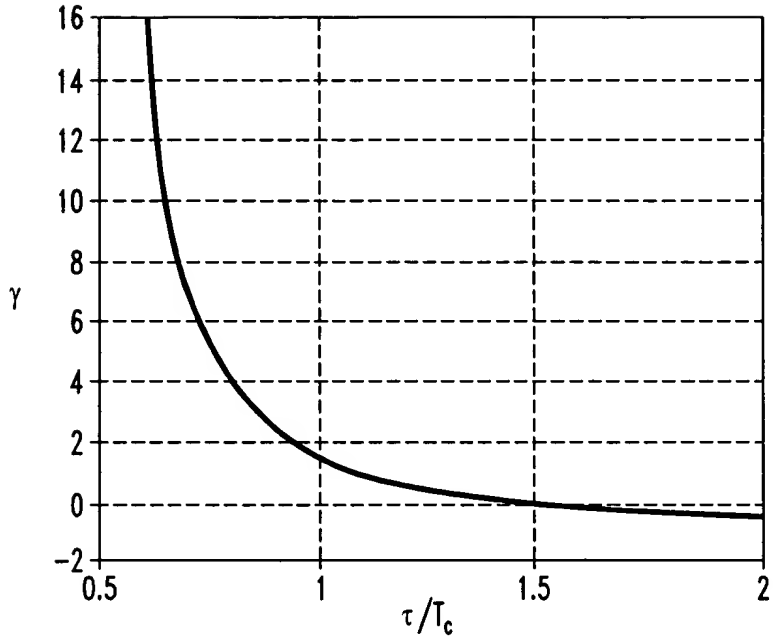


FIG. 10

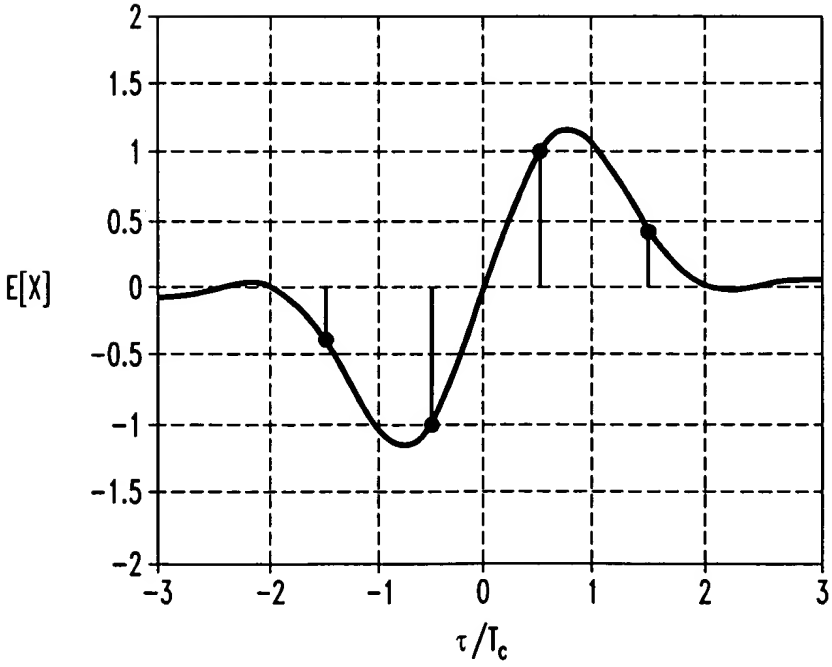


FIG. 11

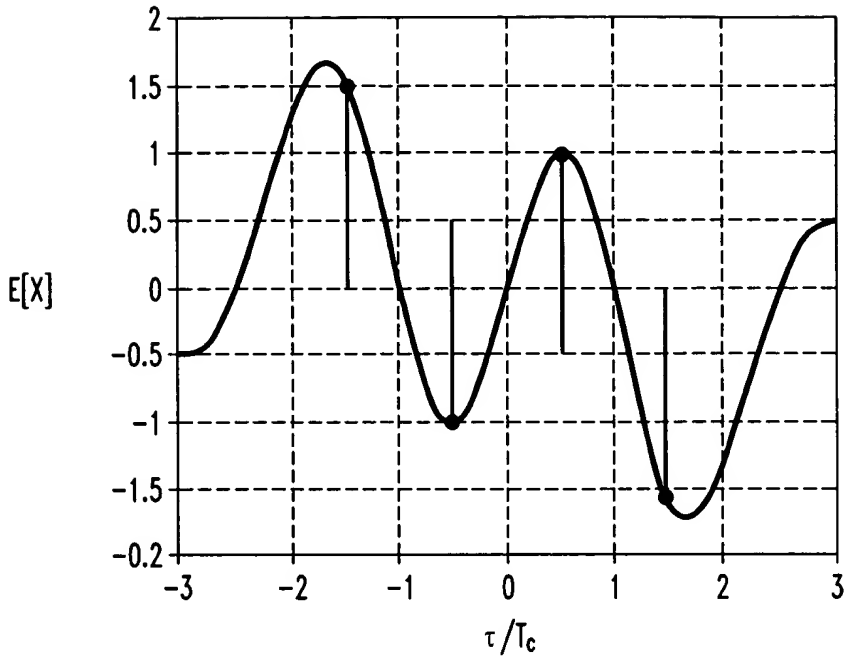

E[X]
2
1.5
1
0.5
0
-0.5
-1
-1.5
-0.2
-3
-2
-1
0
1
2
3
τ/Tc

FIG. 12

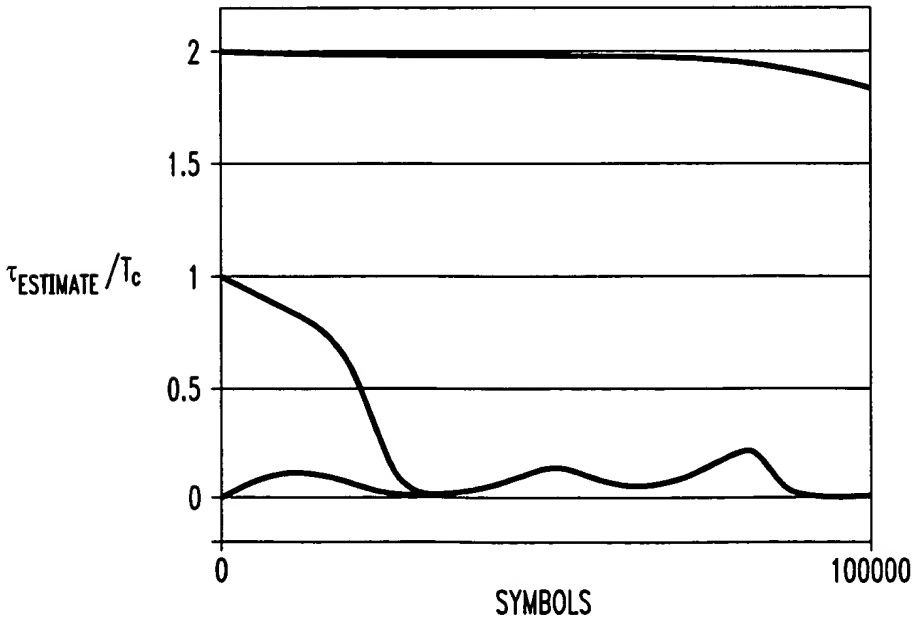

τESTIMATE/Tc
2
1.5
1
0.5
0
0
100000
SYMBOLS

FIG. 13

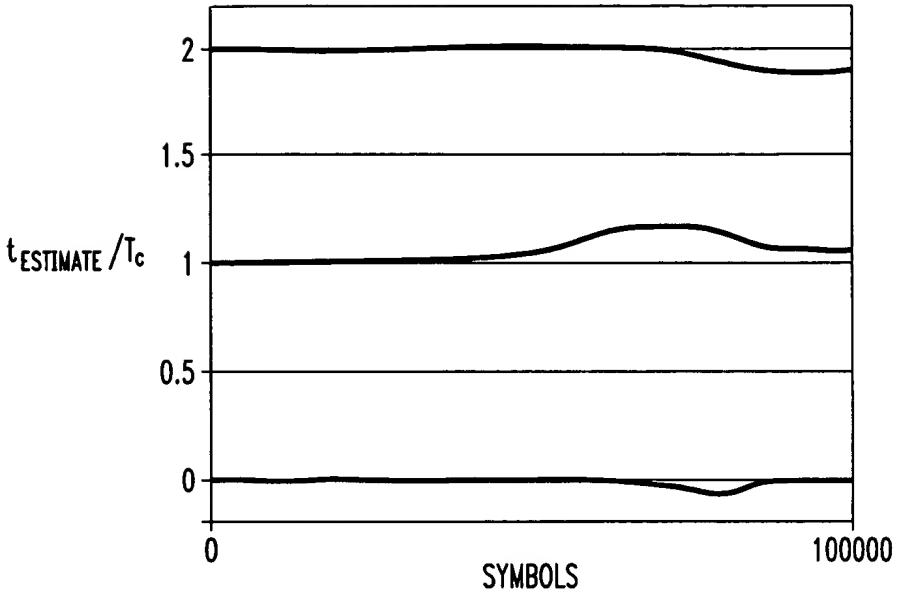

2
1.5
1
0.5
0
$t_{ESTIMATE}/T_c$
0
100000
SYMBOLS

FIG. 14

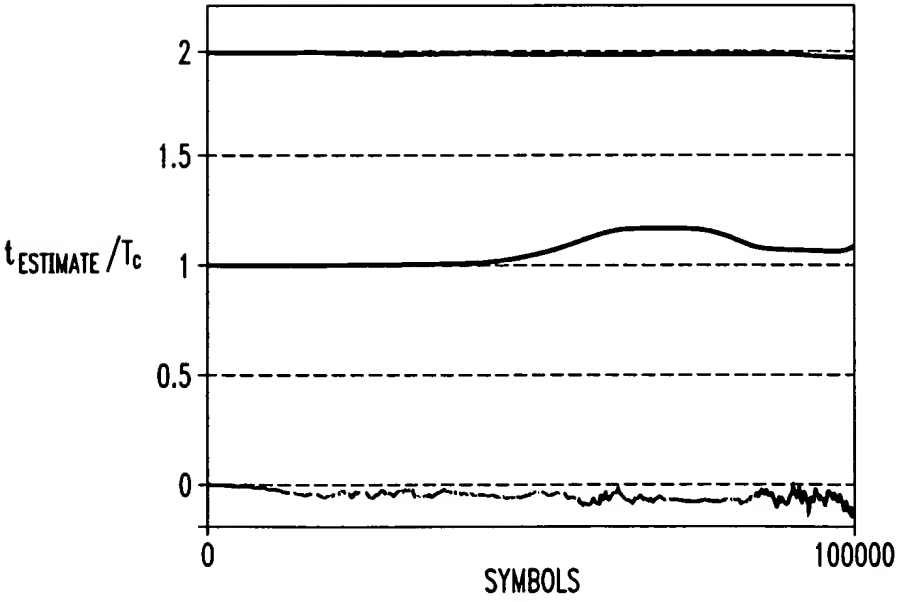

2
1.5
1
0.5
0
$t_{ESTIMATE}/T_c$
0
100000
SYMBOLS

FIG. 15

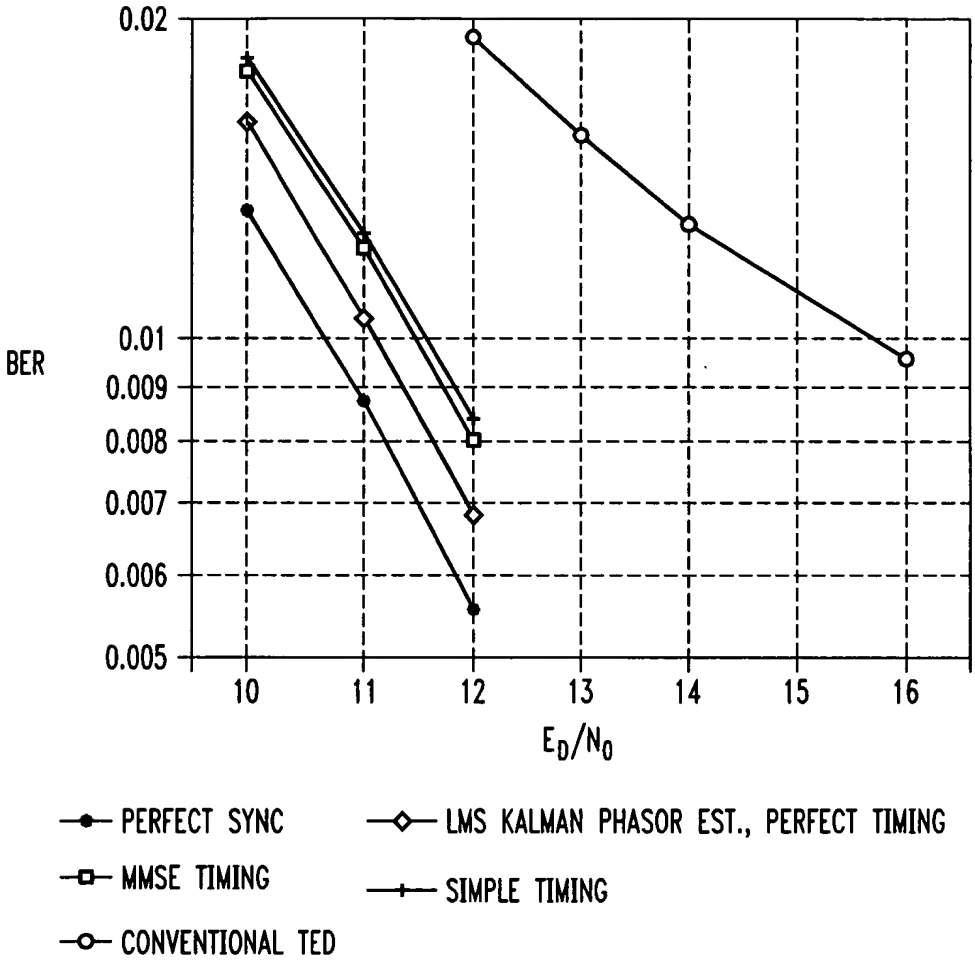
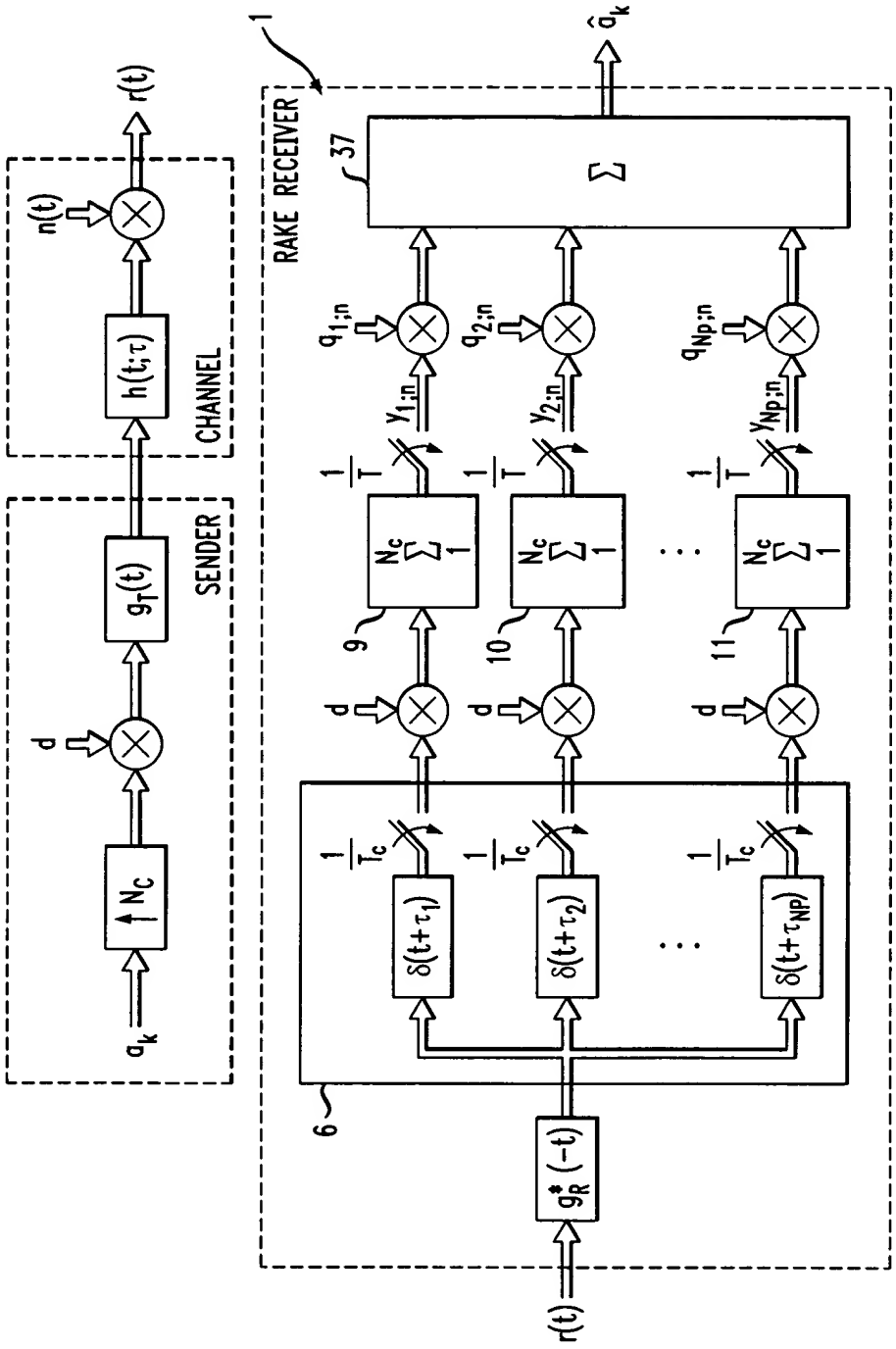

0.02
0.01
0.009
0.008
0.007
0.006
0.005
BER
10
11
12
13
14
15
16
E_D/N_0
PERFECT SYNC
LMS KALMAN PHASOR EST., PERFECT TIMING
MMSE TIMING
SIMPLE TIMING
CONVENTIONAL TED

FIG. 16


SENDER
CHANNEL
RAKE RECEIVER
a_k
N_c
$g_T(t)$
d
$h(t;\tau)$
n(t)
r(t)
$g_R^*(-t)$
$\delta(t+\tau_1)$
$\delta(t+\tau_2)$
$\delta(t+\tau_{Np})$
$\frac{1}{T_c}$
$\frac{1}{T}$
$N_c \sum 1$
$q_{1;n}$
$q_{2;n}$
$q_{Np;n}$
$y_{1;n}$
$y_{2;n}$
$y_{Np;n}$
Σ
$\hat{a}_k$
1
6
9
10
11
37

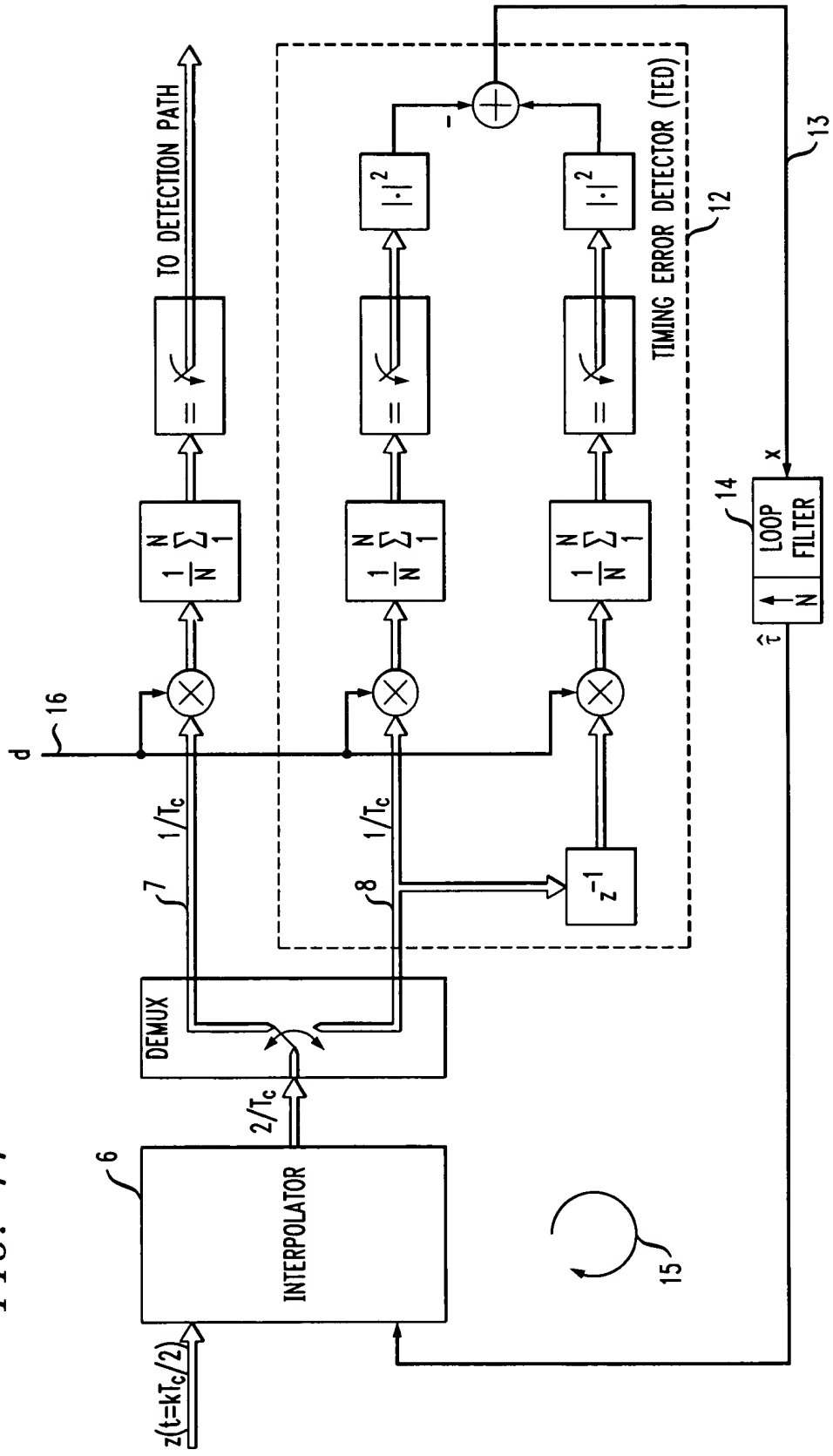

TO DETECTION PATH
TIMING ERROR DETECTOR (TED)
12
13
14
LOOP FILTER
x
$\hat{\tau}$
N
16
d
$1/T_c$
7
8
DEMUX
$2/T_c$
6
INTERPOLATOR
15
$z(t=kT_c/2)$
z^{-1}
$|\cdot|^2$
$\frac{1}{N}\sum_{1}^{N}$

FIG. 17

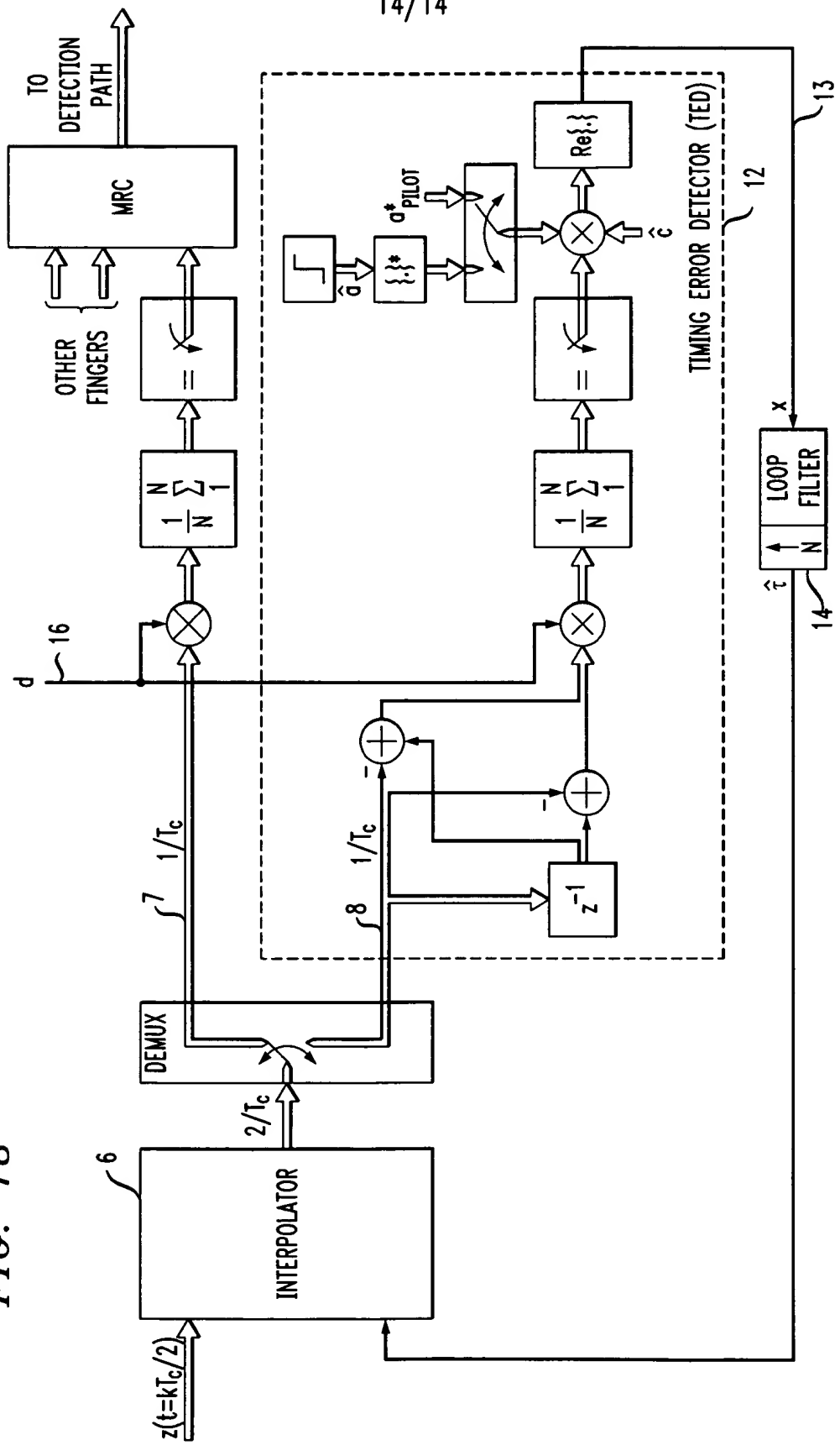

TO DETECTION PATH
MRC
OTHER FINGERS
TIMING ERROR DETECTOR (TED)
12
13
Re{.}
a^*_{PILOT}
$\hat{a}$
$\hat{c}$
x
LOOP FILTER
N
$\hat{\tau}$
14
d
16
$\frac{1}{N}\sum_{1}^{N}$
$1/T_c$
7
8
z^{-1}
DEMUX
$2/T_c$
6
INTERPOLATOR
$z(t=kT_c/2)$

FIG. 18